Form AEC-313
(2-73)
10 CFR 30

UNITED STATES ATOMIC ENERGY COMMISSION

APPLICATION FOR BYPRODUCT MATERIAL LICENSE

Form approved
Budget Bureau No. 38-R0027

INSTRUCTIONS.—Complete Items 1 through 16 if this is an initial application or an application for renewal of a license. Information contained in previous applications filed with the Commission with respect to Items 8 through 15 may be incorporated by reference provided *references are clear and specific.* Use supplemental sheets where necessary. Item 16 must be completed on all applications. Mail two copies to: U.S. Atomic Energy Commission, Washington, D.C., 20545, Attention: Materials Branch, Directorate of Licensing. Upon approval of this application, the applicant will receive an AEC Byproduct Material License. An AEC Byproduct Material License is issued in accordance with the general requirements contained in Title 10, Code of Federal Regulations, Part 30, and the Licensee is subject to Title 10, Code of Federal Regulations, Part 20, and the license fee provisions of Title 10, Code of Federal Regulations, Part 170. The license fee category should be stated in Item 16 and the appropriate fee enclosed. (See Note in Instruction Sheet).

1. (a) NAME AND STREET ADDRESS OF APPLICANT. *(Institution, firm, hospital person, etc. Include ZIP Code and telephone number.)*

Department of the Army
US Army Electronics Command
Directorate of Research, Development and Engineering
Fort Monmouth, New Jersey 07703

(b) STREET ADDRESS(ES) AT WHICH BYPRODUCT MATERIAL WILL BE USED. *(If different from 1(a). Include ZIP Code.)*

Evans Area
Intersection of Marconi Road and Brighton Avenue
Neptune, New Jersey

2. DEPARTMENT TO USE BYPRODUCT MATERIAL

No Change

3. PREVIOUS LICENSE NUMBER(S). *(If this is an application for renewal of a license, please indicate and give number.)*

Amend NRC BP License Number 29-01022-07.

4. INDIVIDUAL USER(S). *(Name and title of individual(s) who will use or directly supervise use of byproduct material. Give training and experience in Items 8 and 9.)*

See Supplement B.

5. RADIATION PROTECTION OFFICER. *(Name of person designated as radiation protection officer if other than individual user. Attach resume of his training and experience as in Items 8 and 9.)*

Stanley B. Potter, RPO
Charles F. Pullen, Alternate RPO
(See Supplement D for training and experience.

6. (a) BYPRODUCT MATERIAL. *(Elements and mass number of each.)*	**(b) CHEMICAL AND/OR PHYSICAL FORM AND MAXIMUM NUMBER OF MILLICURIES OF EACH CHEMICAL AND/OR PHYSICAL FORM THAT YOU WILL POSSESS AT ANY ONE TIME.** *(If sealed source(s), also state name of manufacturer, model number, number of sources and maximum activity per source.)*
Cobalt 60	Sealed sources, total activity not to exceed [ ] of cobalt metal (See Supplement C).

7. DESCRIBE PURPOSE FOR WHICH BYPRODUCT MATERIAL WILL BE USED. *(If byproduct material is for "human use," supplement A (Form AEC-313a) must be completed in lieu of this item. If byproduct material is in the form of a sealed source, include the make and model number of the storage container and/or device in which the source will be stored and/or used.)*

a. The sealed sources will be used in research, development and testing programs and may be used in calibration of high range instruments. See Supplement E of application for renewal of NRC License 29-01022-06 dated 4 Sep 75 for detailed information regarding research, development and testing programs.

b. See Supplement E for information regarding sealed source storage and use containers.

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(Continued on reverse side)

TRAINING AND EXPERIENCE OF EACH INDIVIDUAL NAMED IN ITEM 4 *(Use supplemental sheets if necessary)*

8. TYPE OF TRAINING	WHERE TRAINED	DURATION OF TRAINING	ON THE JOB (Circle answer)	FORMAL COURSE (Circle answer)
a. Principles and practices of radiation protection			Yes No	Yes No
b. Radioactivity measurement standardization and monitoring techniques and instruments	No Change		Yes No	Yes No
c. Mathematics and calculations basic to the use and measurement of radioactivity			Yes No	Yes No
d. Biological effects of radiation			Yes No	Yes No

9. EXPERIENCE WITH RADIATION. *(Actual use of radioisotopes or equivalent experience.)*

ISOTOPE	MAXIMUM AMOUNT	WHERE EXPERIENCE WAS GAINED	DURATION OF EXPERIENCE	TYPE OF USE
		No Change		

10. RADIATION DETECTION INSTRUMENTS. *(Use supplemental sheets if necessary.)*

TYPE OF INSTRUMENTS *(Include make and model number of each)*	NUMBER AVAILABLE	RADIATION DETECTED	SENSITIVITY RANGE *(mr/hr)*	WINDOW THICKNESS *(mg/cm²)*	USE *(Monitoring, surveying, measuring)*
			No Change		

11. METHOD, FREQUENCY, AND STANDARDS USED IN CALIBRATING INSTRUMENTS LISTED ABOVE.

No Change

12. FILM BADGES, DOSIMETERS, AND BIO-ASSAY PROCEDURES USED. *(For film badges, specify method of calibrating and processing, or name of supplier.)*

No Change

INFORMATION TO BE SUBMITTED ON ADDITIONAL SHEETS IN DUPLICATE

13. FACILITIES AND EQUIPMENT. Describe laboratory facilities and remote handling equipment, storage containers, shielding, fume hoods, etc. Explanatory sketch of facility is attached. *(Circle answer)* Yes No

See Supplement E

14. RADIATION PROTECTION PROGRAM. Describe the radiation protection program including control measures. If application covers sealed sources, submit leak testing procedures where applicable, name, training, and experience of person to perform leak tests, and arrangements for performing initial radiation survey, servicing, maintenance and repair of the source.

No Change

15. WASTE DISPOSAL. If a commercial waste disposal service is employed, specify name of company. Otherwise, submit detailed description of methods which will be used for disposing of radioactive wastes and estimates of the type and amount of activity involved.

No Change

CERTIFICATE (This item must be completed by applicant)

16. THE APPLICANT AND ANY OFFICIAL EXECUTING THIS CERTIFICATE ON BEHALF OF THE APPLICANT NAMED IN ITEM 1, CERTIFY THAT THIS APPLICATION IS PREPARED IN CONFORMITY WITH TITLE 10, CODE OF FEDERAL REGULATIONS, PART 30, AND THAT ALL INFORMATION CONTAINED HEREIN, INCLUDING ANY SUPPLEMENTS ATTACHED HERETO, IS TRUE AND CORRECT TO THE BEST OF OUR KNOWLEDGE AND BELIEF.

License Fee Category $ _____

Fee Enclosed $ _____

Date 5 May 1976

US Army Electronics Command, RD&E Dir.
Applicant named in item 1

By: Walter S. McAfee

WALTER S. MC AFEE
CG's Representative on the USAECOM's
Title of certifying official

Ionizing Radiation Control Committee

WARNING.—18 U. S. C., Section 1001; Act of June 25, 1948; 62 Stat. 749; makes it a criminal offense to make a willfully false statement or representation to any department or agency of the United States as to any matter within its jurisdiction.

Remove page B-1 from application received by NRC on Sep 4, 1973 and replace with this page.

SUPPLEMENT B

SUBJECT: Individual Users

1. Reference: Form NRC-313, Item 4.

2. Users of radioactive material. The use of radioactive material covered by this license shall be limited to:

   a. The RD&E RPO, Alternate RPO, and Technical Staff of RPO.

   b. Personnel to Perform Leak Tests.

   c. Individuals approved by the Committee who are:

      (1) RD&E employees stationed at Fort Monmouth.

      (2) Non-RD&E employees working at Fort Monmouth on RD&E research, development or test programs.

   d. An individual(s) working under the direct supervision of an RD&E employee approved by the Committee to directly supervise the individual's work with the radioactive material involved. The individual performing the work need not be an RD&E employee. The work may take place at locations designated in Supplement A. The primary duty station of the employee performing the direct supervision will be Fort Monmouth, New Jersey.

      Note that direct supervision means that the supervisor is in a physical location where he can see the individual(s) being supervised or he is in a nearby area where he can hear a call or signal from said individual(s) and be able to reach the location where the individual(s) is working within a few moments.

3. Qualifications of Users and "Radiation Supervisors" Approved by the Committee. The Committee evaluates an applicant's (a) experience with radiation and radioactive material, (b) training in the principles and practices of radiation protection, radioactivity measurement standardization and monitoring techniques and instruments, mathematics and calculations basic to the use and measurement of radioactivity, and the biological effects of radiation, and (c) his familiarity with pertinent regulations and procedures, to insure they are commensurate with the hazard and activity of the radioisotopes requested in his application.

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Remove page B-[illegible] from application received by NRC on Sep 4, 1973 and replace with this page.

4. See Supplement F of Application for renewal and amendment of NRC BP License Number 29-01022-06 dated 4 Sep 75 for:

   a. List of individuals who serve as:

      (1) RPO, Alternate RPO, and Technical Staff of RPO.

      (2) Personnel to perform leak tests.

   b. Training and Experience of Individuals who serve in the above-mentioned capacities.

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Remove page C-1 from application received by NRC on Sep 4, 1973 and replace with this page.

SUPPLEMENT C

SUBJECT: Cobalt 60 Sealed Sources

1. Reference: Form NRC-313, Item 6(b).

2. See sealed source drawings in Supplement E for details of construction of sources.

3. Source activity as of 29 Feb 1976.

   a. Source No. 1 - [redacted]

   b. Source No. 2 - [redacted]

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Remove page D-1 from application received by NRC on Sep 4, 1973 and replace with this page.

SUPPLEMENT D

SUBJECT: Training and Experience.

1. Reference: Form NRC 313, Items 4, 5, 8, 9 and 14.

2. See Supplement G of Application for Renewal and Amendment of NRC BP License Number 29-01022-06 dated 4 Sep 75.

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Remove pages E-1 through E-12 from application received by NRC on 4 Sep 1973 and replace with pages E-1 through E-13 submitted herewith.

SUPPLEMENT E

SUBJECT: Facilities and Equipment.

1. Reference: Form NRC-313, Item 13.

2. The location of the underground area, consisting of the Vault Console and Exposure Room, in relation to the remainder of Bldg 401 is shown in Fig. E-1.

3. The Vault Exposure Room (see Figs. E-2 & E-3) was designed for the use of a [redacted] cobalt-60 sealed source. The figures show the 18" thick wall that extends the maze 5'4" into the Vault Exposure Room. Interlocking ferrite brick were used in the construction of the wall. The ferrite block used on each side of the Zinc Bromide Window in the wall between Vault Console and Exposure Room is also shown in the same figures.

4. Fig. E-4 shows the relative locations of the various alarm sensors, a warning light that is lit when either source is "up" and other pertinent components. Other warning lights that are lit when either source is "up" are located on top of the earth mound (Fig. E-3), in the hall at the top of the stairs, and on the control console.

5. The components shown in Figs. E-5, E-6, E-7 and E-8 and the pneumatic and electrical systems (see Figs. E-9 and E-10) make up the storage and use device for the 660 curie source. The Shield and Rise Tube Adaptor of the Rise Tube Assembly shown in Fig. E-6 fits into the plug well, Item 3 of Fig. E-5. The Rise Tube Assembly is held in place by a Plug Plate that fits over the shoulder of the Shield and Rise Tube Adapter and the top of the Primary Source Storage Shield. The Plug Plate is held down by nuts screwed onto the stainless steel lugs (see item 4 of Fig. E-5). The Rise Tube Extension is screwed and bolted onto the top of the Rise Tube (Fig. E-6).

6. The Bowden Cable passes through the shield wall between the Exposure Room and the Console Room (see Fig. E-3). Thus the catch (see Fig. E-6) for holding the rise tube plug of the 660 Ci source may be released from the Console Room. The Master/Slave Manipulators (Fig. E-3) are used to raise and lower this rise tube plug. The 660 Ci sealed source is in an outer capsule (see Figs. E-6 and E-8) that is raised and lowered pneumatically.

7. The electrical control system schematic is shown in Fig. E-10. The electrical interlock system will cause both sources to be lowered into their respective Source Storage Shields if:

   a. The maze door is opened,

   b. The zinc bromide in the observation window is low,

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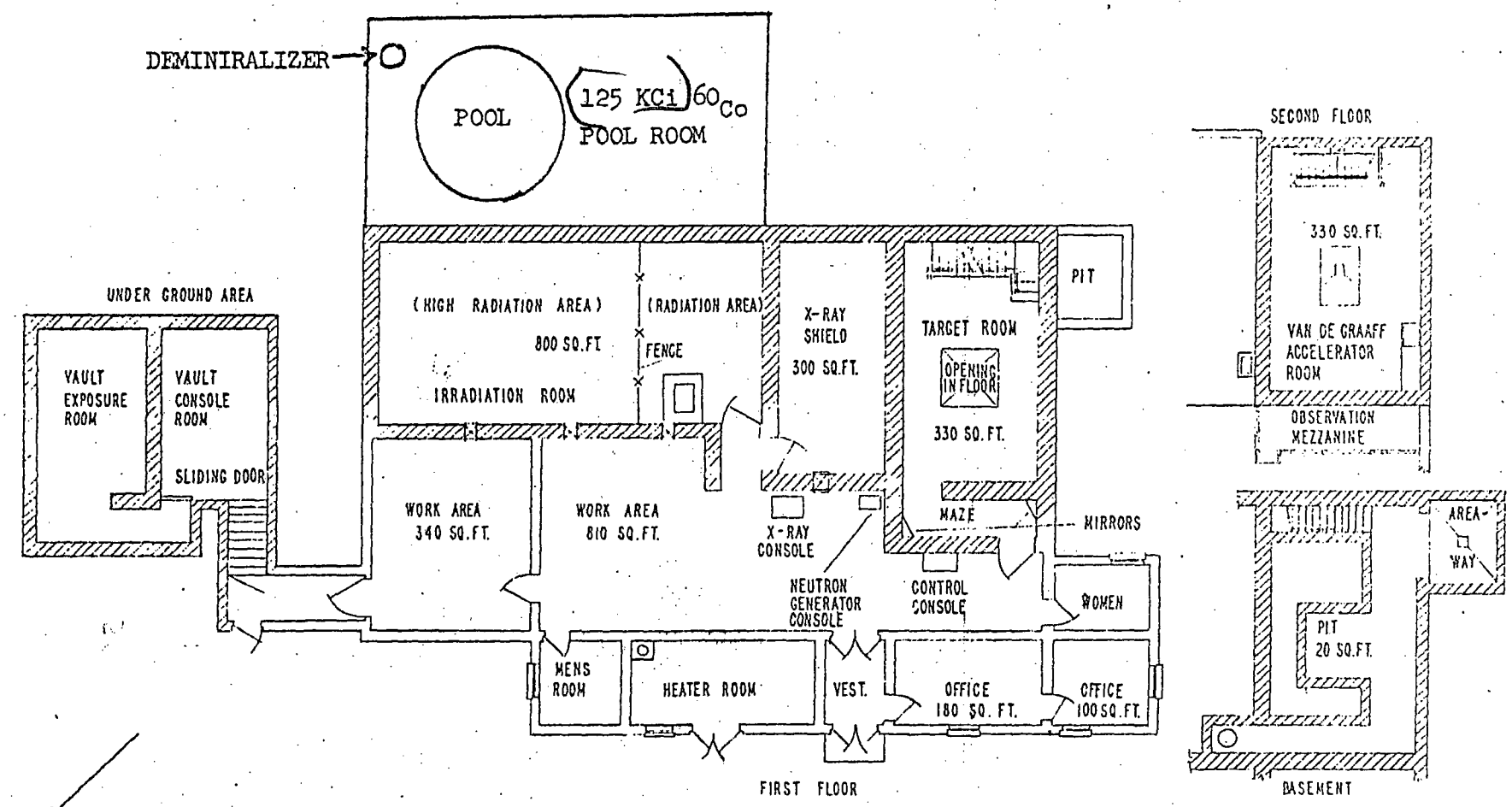


Fig. E-1 [redacted] EVANS AREA

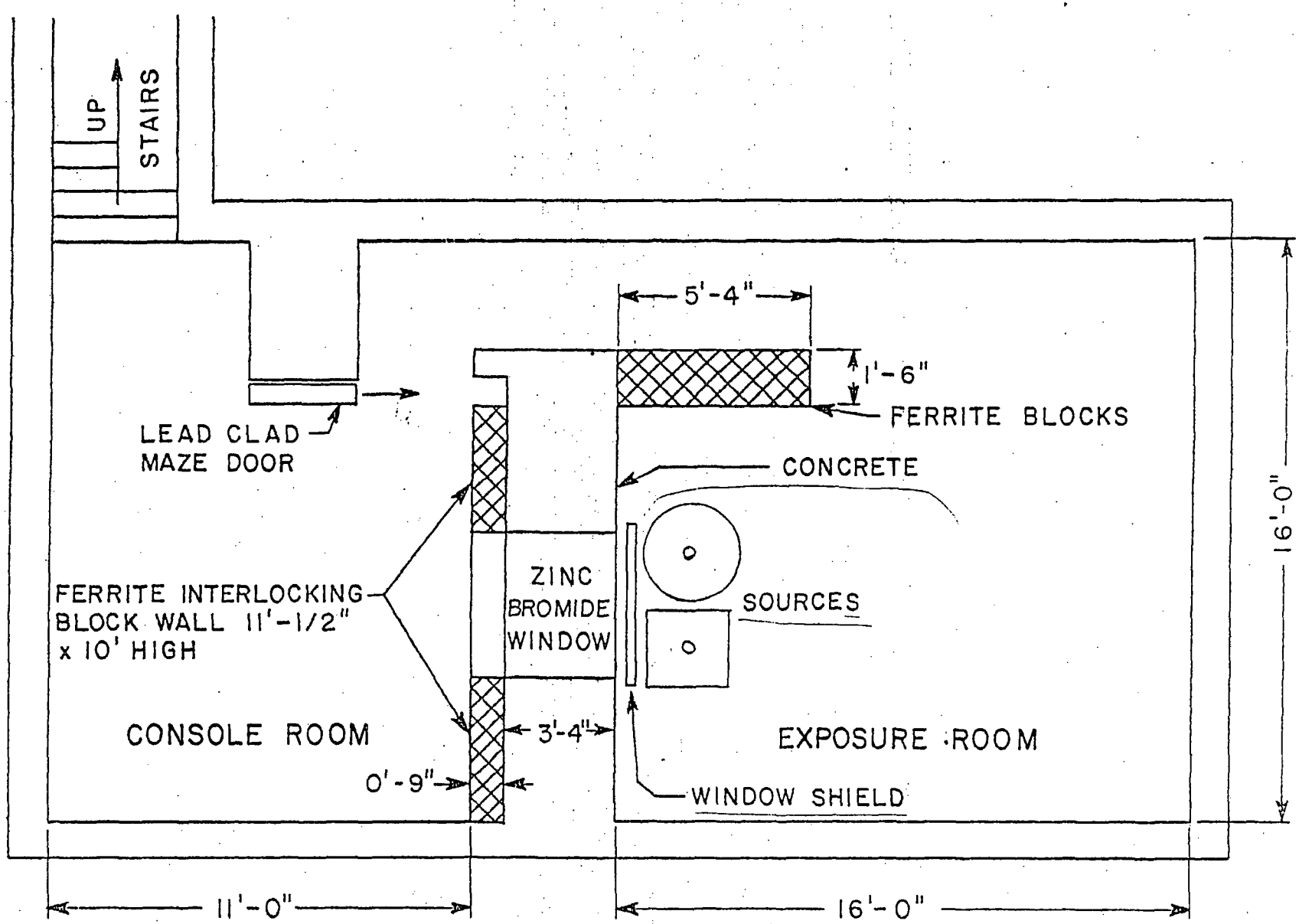


FIG. E-2. PLAN VIEW UNDERGROUND VAULT

SCALE $\frac{1}{4}$" = 1' - 0"

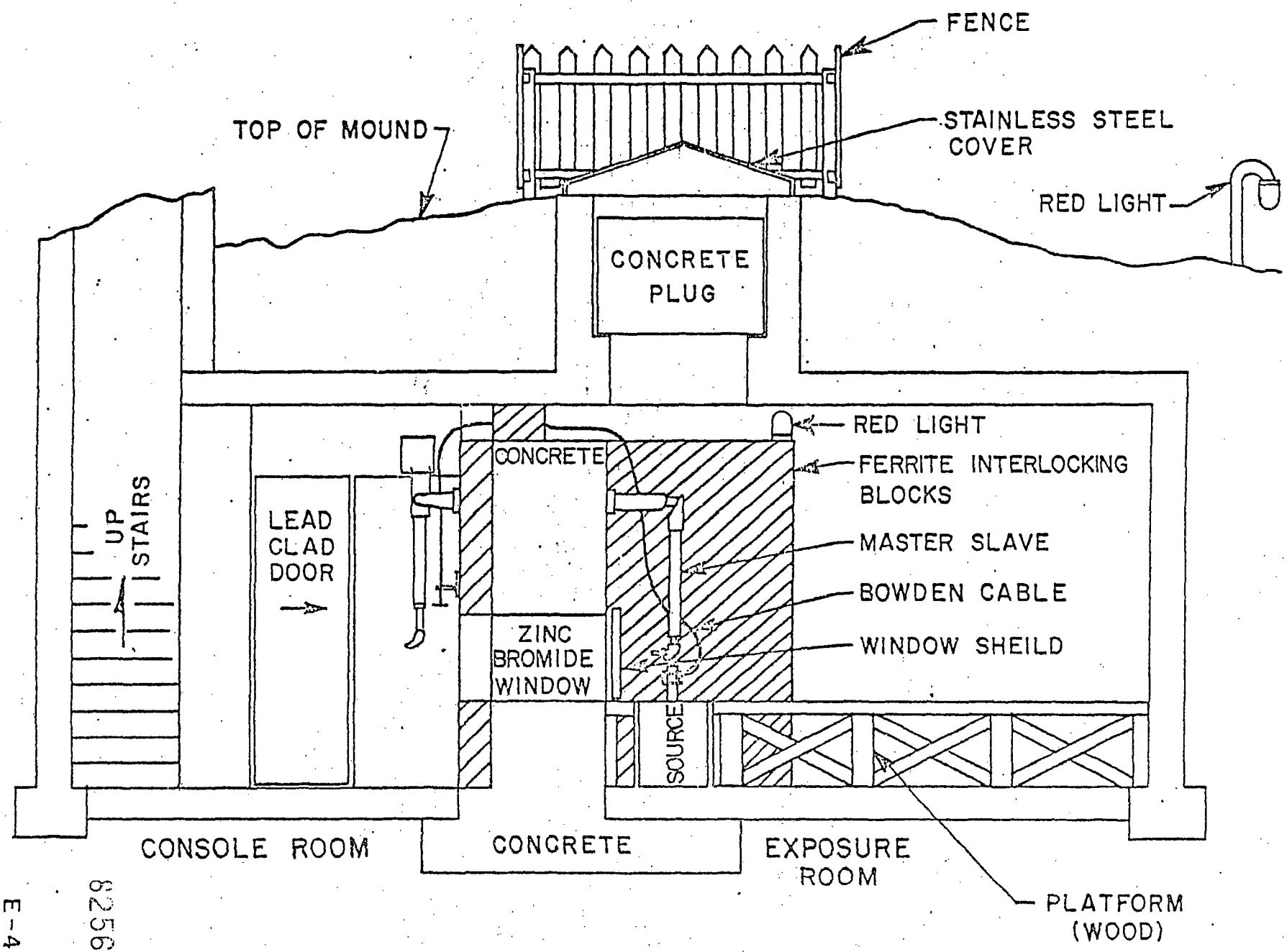
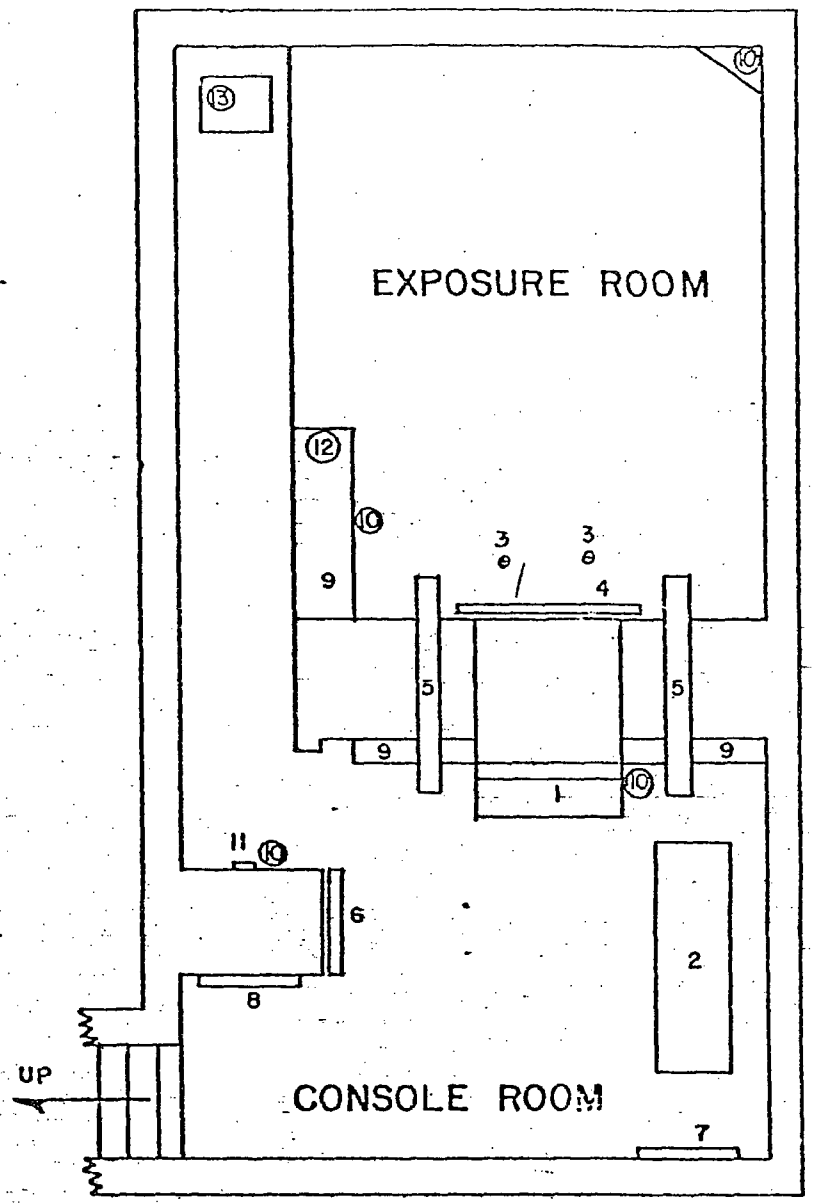


FIG.E.3. ELEVATION VIEW UNDERGROUND VALT



1. CONTROL CONSOLE
2. MONITOR CONSOLE
3. SOURCE POSITION
4. WINDOW SHIELD
5. SLAVE MANIPULATORS
6. MAZE DOOR
7. PNEUMATIC CONTROL SYSTEM
8. ELECTRICAL PANEL
9. FERRITE INTERLOCKING BLOCK
10. RADIATION ALARM SENSORS
11. MANUAL ALARM SENSORS
12. WARNING LIGHT
13. SUMP PUMP

FIG. E-4: UNDERGROUND VAULT INSTRUMENTATION

SCALE $\frac{3"}{16}$ = 1'

1. AISI 1/4" TYPE 316 STAINLESS STEEL (ANNEALED, PICKLED & OILED
2. STAINLESS STEEL ARC WELDING (ALL WELDING)
3. PLUG WELL 3" I.D. X 12 1/2" DEEP
4. STAINLESS STEEL LUGS FOR PLUG PLATE
5. 1" DIA. STAINLESS STEEL RODS
6. LIFTING HOLES
7. THREADED PLATE
8. BASE MOUNTING
9. PLUG PLATE

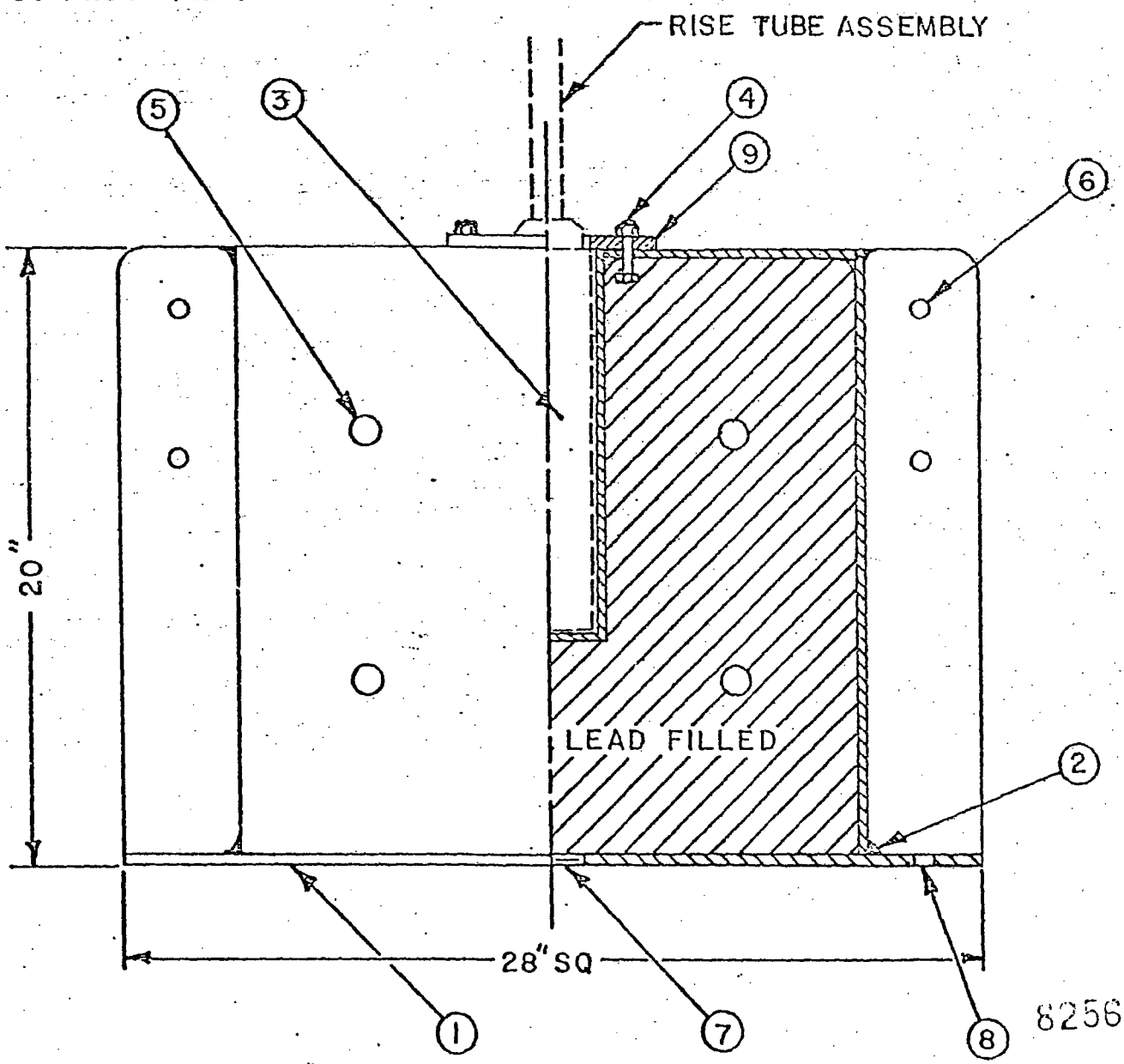


FIG. E-5. PRIMARY SOURCE STORAGE SHIELD

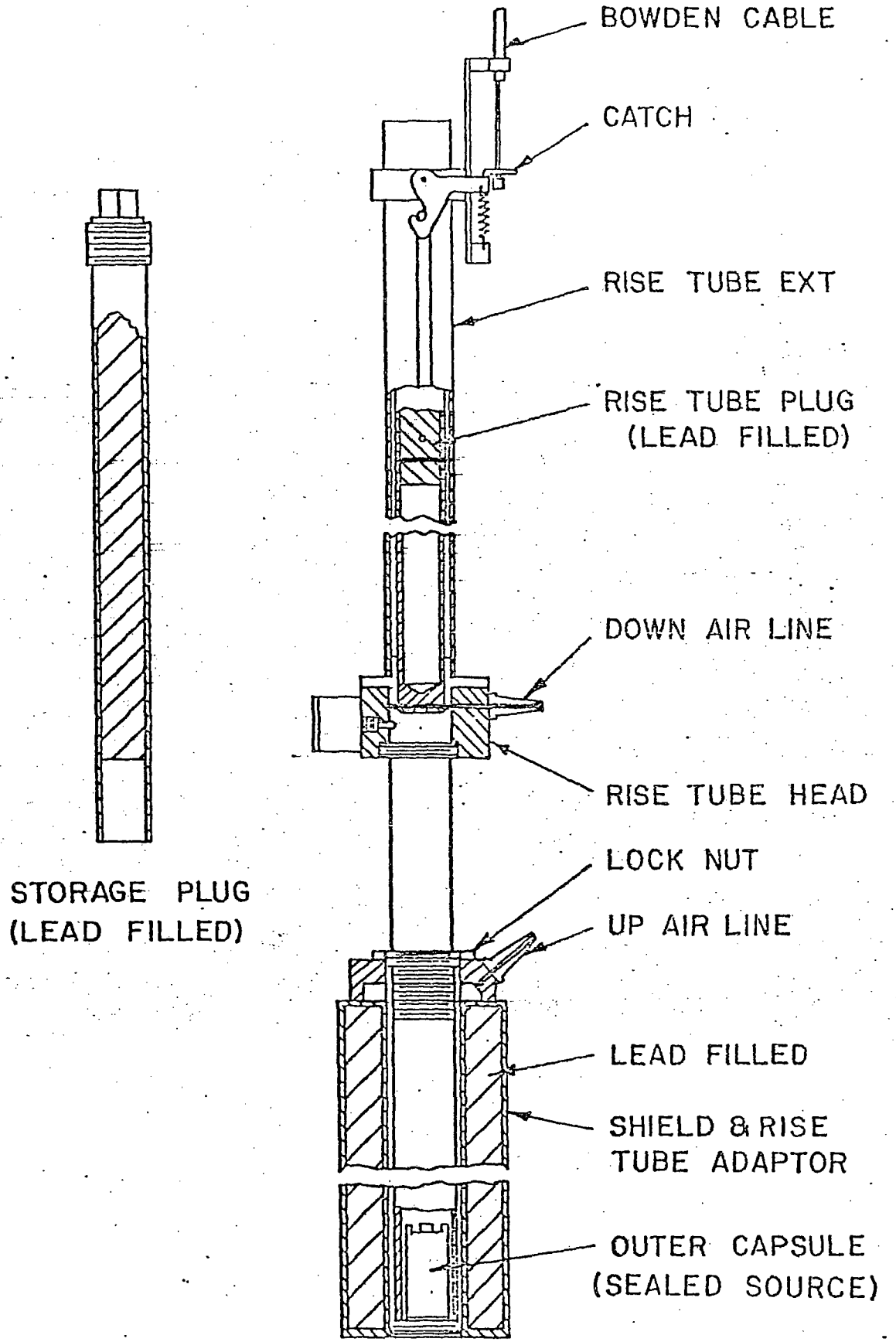
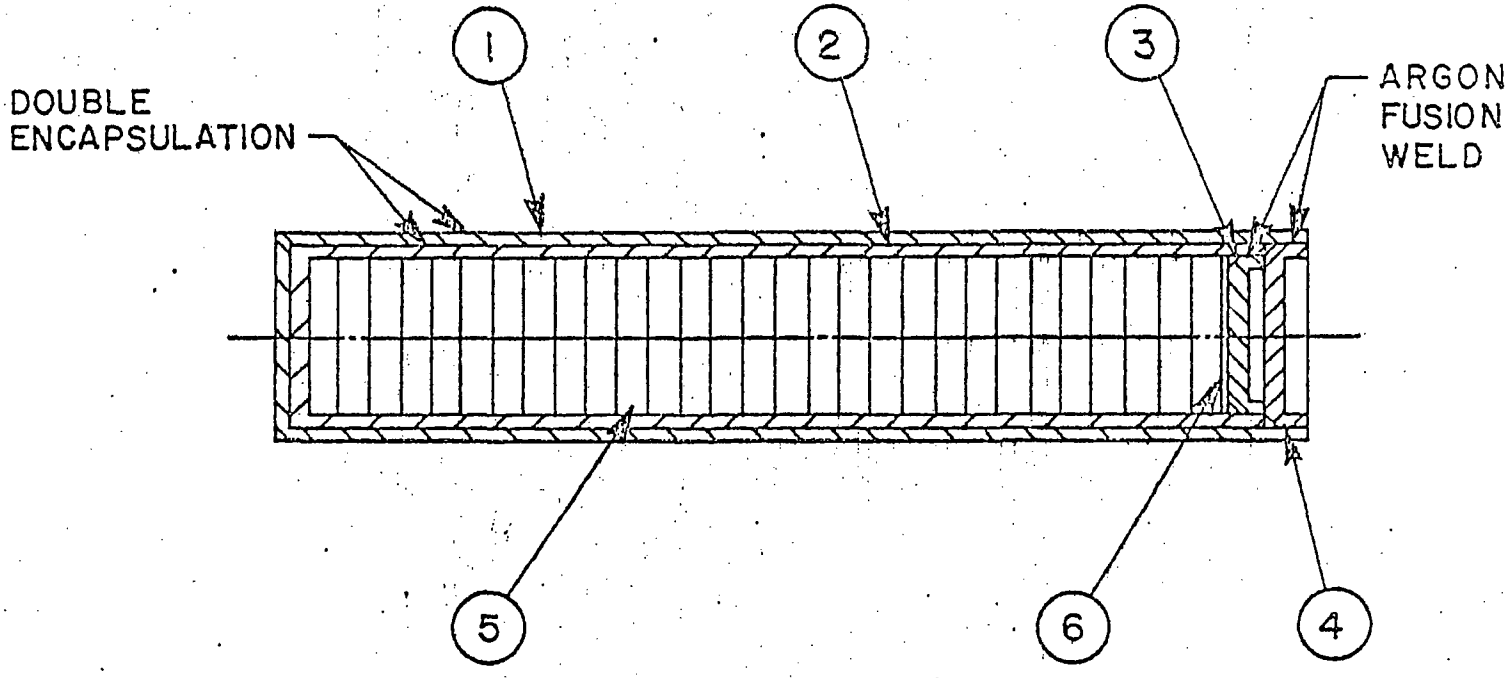


FIG. E-6. CAPSULE & RISE TUBE ASSEMBLY



1. OUTER CAN, 304L STAINLESS STEEL
2. INNER CAN " " "
3. INNER CAP " " "
4. OUTER CAP " " "
5. WAFER, NICKEL PLATED COBALT
6. SPRING, 020 DIA WIRE STAINLESS STEEL

FIG. E-7. COBALT 60 SEALED SOURCE

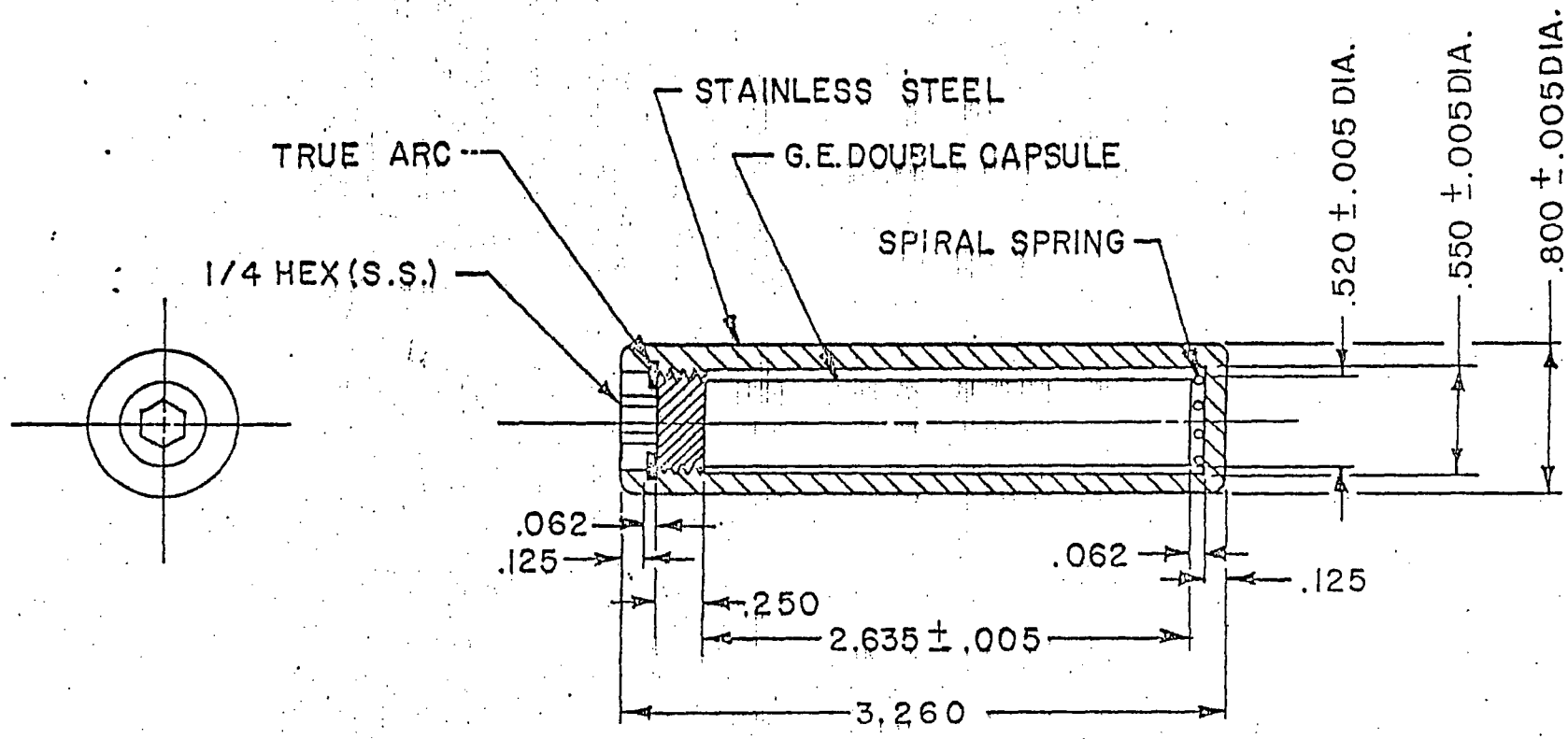


Fig. E-8. OUTER CAPSULE FOR [redacted] SOURCE

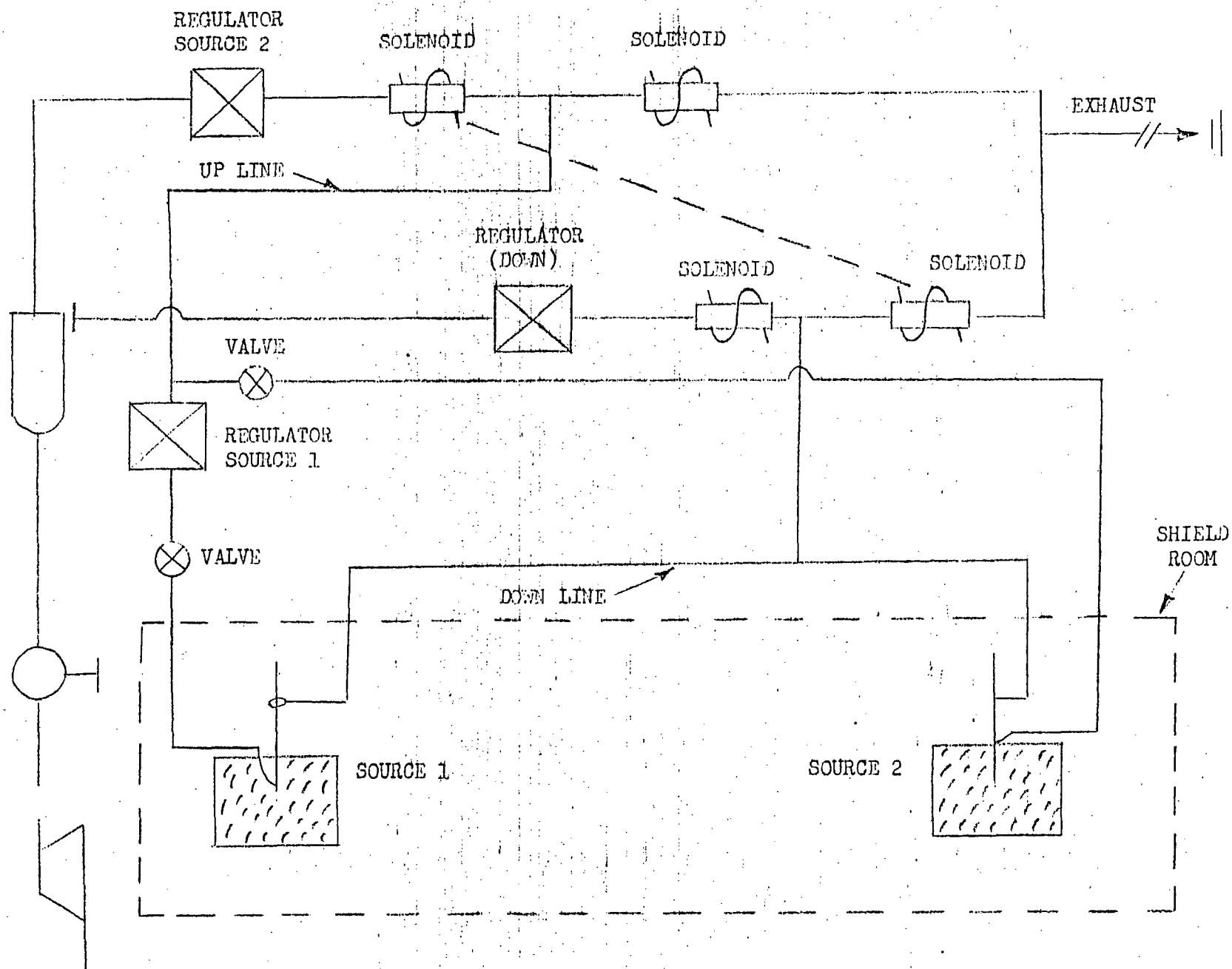
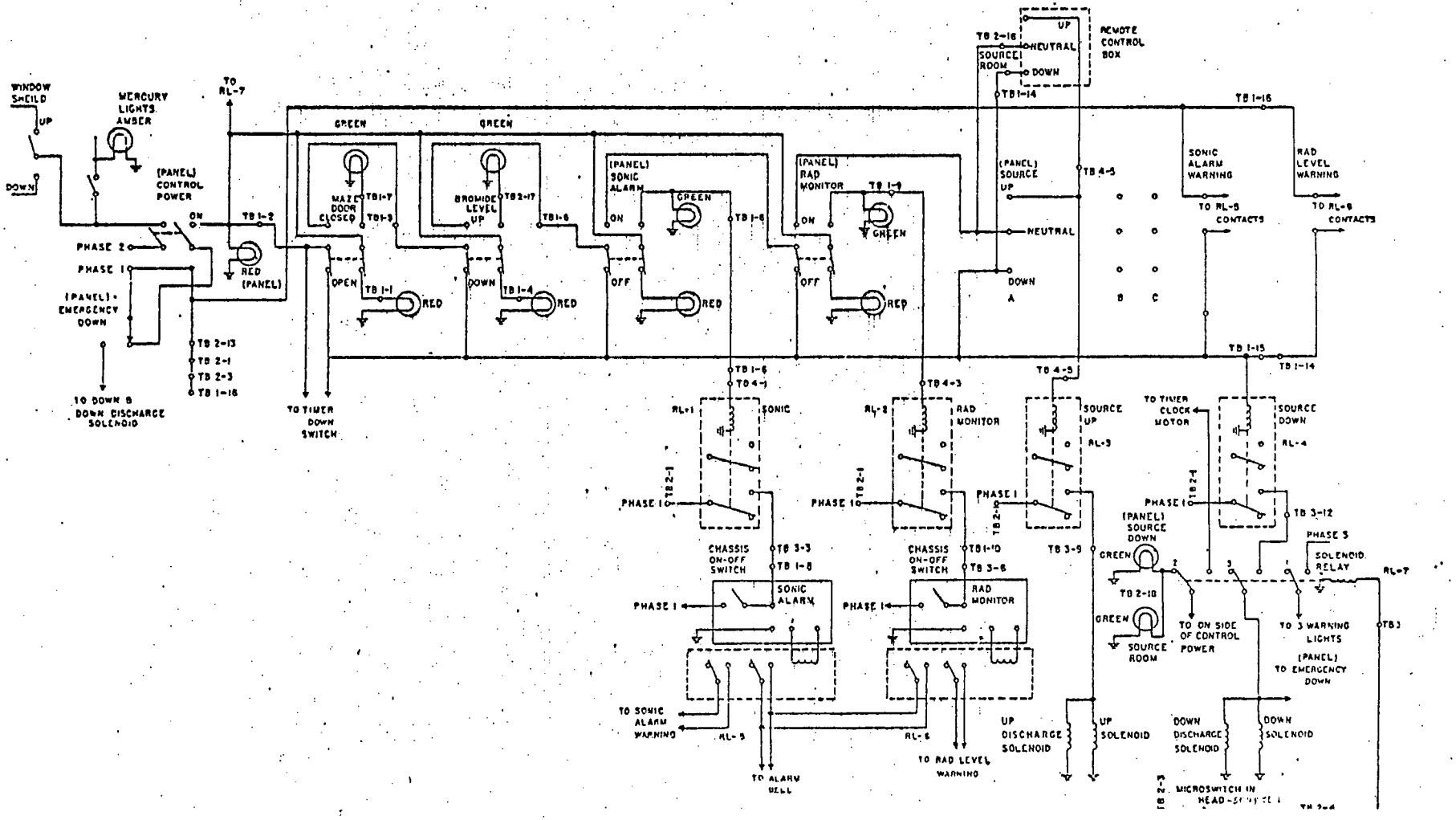


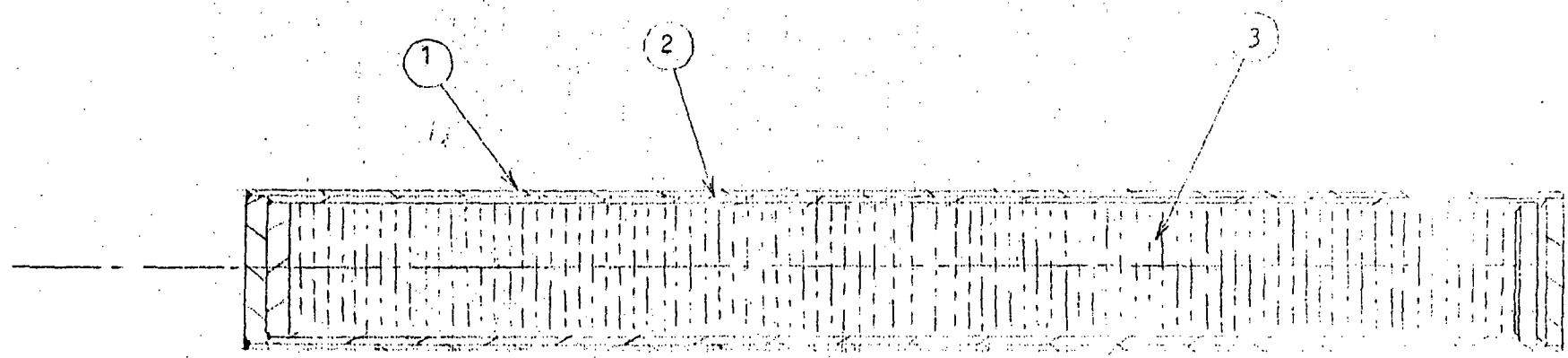
FIG. E-9. PNEUMATIC CONTROL SYSTEM.

SOURCE 1 - (SOURCE

SOURCE 2 - (SOURCE


WINDOW SHEILD
UP
DOWN
MERCURY LIGHTS AMBER
(PANEL) CONTROL POWER
ON
PHASE 2
PHASE 1
(PANEL) EMERGENCY DOWN
TO DOWN & DOWN DISCHARGE SOLENOID
TB 2-13
TB 2-1
TB 2-3
TB 1-16
TO RL-7
TB 1-2
RED (PANEL)
TO TIMER DOWN SWITCH
GREEN
MAZE DOOR CLOSED
TB1-7
TB1-9
OPEN
TB 1-1
RED
GREEN
BROMIDE LEVEL UP
TB2-17
TB1-6
DOWN
TB 1-4
RED
(PANEL) SONIC ALARM
ON
GREEN
TB 1-6
OFF
RED
(PANEL) RAD MONITOR
TB 1-9
ON
GREEN
OFF
RED
TB 2-16
SOURCE ROOM
UP
NEUTRAL
DOWN
REMOTE CONTROL BOX
TB1-14
(PANEL) SOURCE
UP
NEUTRAL
DOWN
A
TB 4-5
B
C
TB 1-16
SONIC ALARM WARNING
TO RL-5 CONTACTS
RAD LEVEL WARNING
TO RL-6 CONTACTS
TB 1-15
TB 1-14
TB 1-6
TB 4-1
RL-1
SONIC
PHASE 1
TB 2-1
CHASSIS ON-OFF SWITCH
TB 3-3
TB 1-8
SONIC ALARM
PHASE 1
TO SONIC ALARM WARNING
RL-5
TO ALARM BELL
TB 4-3
RL-2
RAD MONITOR
PHASE 1
TB 2-1
CHASSIS ON-OFF SWITCH
TB1-10
TB 3-6
RAD MONITOR
PHASE 1
RL-6
TO RAD LEVEL WARNING
TB 4-5
SOURCE UP
RL-3
PHASE 1
TB 2-1
TB 3-9
UP DISCHARGE SOLENOID
UP SOLENOID
TO TIMER CLOCK MOTOR
SOURCE DOWN
RL-4
PHASE 1
TB 2-4
TB 3-12
(PANEL) SOURCE DOWN
GREEN
TB 2-18
GREEN
SOURCE ROOM
TO ON SIDE OF CONTROL POWER
PHASE 3
SOLENOID RELAY
RL-7
TO 3 WARNING LIGHTS
TB3
(PANEL) TO EMERGENCY DOWN
DOWN DISCHARGE SOLENOID
DOWN SOLENOID
MICROSWITCH IN HEAD

B x 2



1. Outer Can, Type 347 Stainless Steel

2. Inner Can, Type 347 Stainless Steel

3. Cobalt-60 Standard Wafers

Source is doubly encapsulated by welding. Outside dimensions of external capsule is 0.935 inch outside diameter by 7.570 inch long. Capsule walls are 0.035 inch thick.

Figure E-11. [redacted] sealed source.

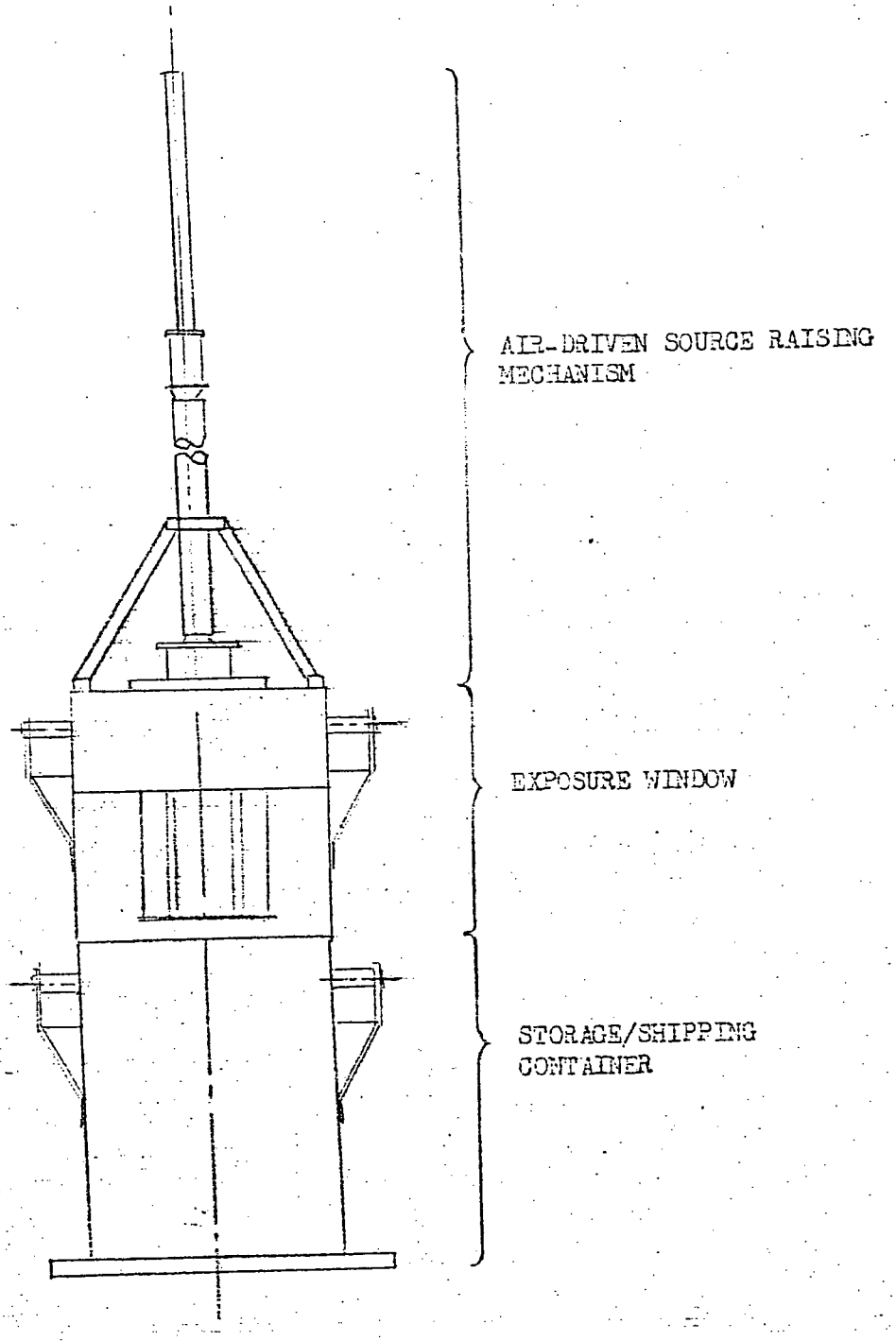


Figure E-12. Mechanism for [redacted] source.

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Remove "Operating Procedures for the Underground Vault Cobalt-60 Irradiation Facility" from application received by NRC on Sep 4, 1973 and replace with the operating instructions submitted herewith.

OPERATING PROCEDURES FOR THE UNDERGROUND VAULT COBALT-60 IRRADIATION FACILITY

LOCATION: Bldg. 401, Evans Area of Fort Monmouth.

ORGANIZATION: Radiation Diagnostics/Applications Research Group; Electronics Materials Research Technical Area; Electronic Technology & Devices Laboratory; Directorate of Research, Development & Engineering; US Army Electronics Command.

1. References:

a. License application for renewal and amendment of NRC License No. 29-01022-07.

b. ECOMR 385-9.

c. RDE/L Policy Memorandum Technical No. 1.

NOTE: Copies of the above references are available in the Console Room in the Office of the Supervisor of Radiation Facilities (Bldg. 401, X65683) and the Radiological Safety Office (Room 150, Bldg. 37D, X65292).

2. Description of Facility: See Supplement E of Reference 1a.

3. Purpose: The purpose of these procedures is to:

a. Provide guidance to individuals who may have occasion to enter the area.

b. Serve as a check list or reminder to operator of approved operations.

c. Serve as a training aid for individuals studying to become approved operators of the facility.

d. Minimize the exposure of personnel to radiation and radioactive material.

e. Minimize the release of radioactive material if the sealed source should rupture.

4. Applicability: These procedures apply to:

a. Visitors.

b. Custodial Personnel.

c. Maintenance Personnel.

d. Individuals who position material to be irradiated.

e. Facility Operators.

f. Operator Trainees.

g. Emergency Personnel (Firemen, Guards, Rescue Squad, etc...)

h. Inspectors.

i. Any other individuals who may have occasion to enter the areas involved.

5. Responsibility:

a. The leader of the Radiation Diagnostics/Applications Research Group or his designated representative is responsible for enforcement of these procedures.

b. The Supervisor of Radiation Facilities or his designated representative have the responsibility of insuring that individuals do not enter the exposure room without an approved operator being present to directly supervise the entrance.

c. Approved operators and individuals authorized to directly supervise the work of individuals undergoing operator training shall insure that the items listed in these Operating Procedures are carried out and that every individual entering the area involved are appraised of the potential hazards.

d. Individuals entering the areas involved have the responsibility of following the instructions given by the approved operator in charge at the time they are in the areas.

6. Personnel Limits:

a. Control Room.

(1) Up to 10 individuals may be in the Control Room when the sources are in their storage position.

(2) Up to 6 individuals may be in the Control Room when any of the sources are in the UP (expose) position. An approved operator must be present when anyone is in the Control Room and any source is in its UP (expose) position.

7. Radioactive Material Limits: The amount of COBALT-60 in the Exposure Room at any one time shall not exceed 3,500 Ci.

8. Radiation Limits:

a. Console Room. The shielding material between the Exposure Room and the Console Room shall be maintained in such a manner that the exposure rate in the Console Room does not exceed 5 mR/hour at locations near the Exposure Room door and the surfaces of other shielding between the two rooms. The average exposure rate in the room shall not exceed 2 mR/hour.

b. Exposure Room. (Sources and shield plug on 660 Ci source down).

(1) The exposure rate over either source, 30 inches above the platform, shall not exceed 250 mR/hour.

(2) The exposure rate 30 inches above the platform and 40 inches from a perpendicular line that passes through either source shall not exceed 1 mR/hour.

9. Exposure Limits: The exposure rates and the length of time spent in the Underground Vault Area shall be controlled so that the exposure limits given in ECOMR 385-9 are not exceeded. NOTE: A copy of ECOMR 385-9 is available for use in the Console Room and in the Office of the Supervisor of Radiation Facilities (Bldg. 401, X65683) and the Radiological Safety Office (Rm 150, Bldg. 37D, X65292).

10. Dosimetry Requirements:

a. Radiation workers shall wear their film badges while in the Underground Vault area.

b. Each individual who performs work in the Exposure Room shall wear a film badge and a pocket dosimeter (0-200 mR) while in the room. At least one of each two individuals working in the room shall wear a "chirpee" type of instrument. The two individuals shall stay together if only one of them is wearing a "chirpee".

c. At least one out of each group of four or less of visitors in the Exposure Room at one time shall wear a personnel dosimeter. The members of such a group shall stay close to each other so that any exposure indicated by the dosimeter will be representative of each member of the group.

d. The Supervisor of Radiation Facilities, the Radiation Protection Officer or one of their designated representatives, or the approved operator in charge of the facility at the time may require the use of additional personnel dosimeters and/or radiation detectors.

11. General Safety Precautions:

a. Individuals wishing to visit the Underground Vault Area, to have material irradiated, or to enter the area for some other reason (other than

for emergency reasons) should schedule the visit so that advance preparations can be made. Contact the Supervisor of Radiation Facilities or his assistant (X65683) to make reservations.

b. Individuals shall sign in and be issued personnel dosimeters, radiation detection and measuring devices before entering the restricted portion of Bldg. 401. These steps are carried out in the Bldg. 401 office nearest the entrance to the building.

c. All individuals going to the Console Room shall be accompanied by an approved operator or his designated representative.

d. Only approved operators or their designated representatives will sign for the key to the Underground Area.

e. Only an approved operator may obtain the key for the switch lock that operates the solenoid air valves that control the positioning of the sources by air flow.

f. An approved operator and at least one other individual shall be in the Underground Vault Area while the door to the Exposure Room is open.

12. Source Storage:

a. The source will be kept in its storage container with the lead plug over the source and the source will be kept in its DOWN position (Since this source is attached to its lead safety plug, the source being DOWN also means the lead plug is DOWN) in its storage container if:

(1) The source is not in use.

(2) Individuals are in the Exposure Room.

(3) A leak test of the source indicates the source is leaking.

(4) Radioactive contamination is found in the Exposure Room.

b. The steps to follow in order to put the sources in their storage positions are listed in Item 14e below.

13. Emergencies:

a. No air pressure.

(1) If source capsule, are in their lead storage containers they cannot be raised to exposure position until air pressure is supplied. A small emergency air compressor can be put into service by opening necessary valves.

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(2) [ ] source capsule in exposure position. The source can be returned to the lead storage container by pulling the handle on the Bowden cable in the Control Room which in turn opens the latch holding the lead storage plug. Then by using the mechanical arm, attached to the plug, the plug can be lowered. The lowering of the plug pushes the source capsule into the lead storage container.

(3) The [ ] source in the exposure or UP position. The source can be returned to the lead storage container by inserting the key in the source control switch and turning the key counterclockwise. This exhausts the air and allows the source to lower.

b. Electrical Power Failure.

(1) The source capsules automatically return to the lead storage containers with any interruption of the electrical circuits.

(2) The emergency power generator automatically energizes if electrical power remains off for more than ten seconds. This emergency generator supplies electrical power to all components and supplies light to operate on during an emergency.

c. If the meter that indicates exposure rate at the source exhaust air vent reads above 3 mR/hour or if there are other indications of the sources leaking:

(1) Cut off the air supply valve to the source controls. This hand valve is located on the wall to the right of the console.

(2) Shut off the Console Room exhaust fan. The switch for this fan is located on the wall beside the electrical panel.

(3) Leave the Underground Vault Area. Close the door at the top of the stairs as you leave. Remove your shoes as you leave the area (they may be contaminated).

(4) Proceed to the Large Work Area of the building. If anyone is in the work area ask them to contact the Supervisor of Radiation Facilities or the Radiological Safety Office (X65292) and ask for assistance. If no one is in the area try to contact the Radiological Safety Office yourself. Two phones are in the large Work Area.

(5) Proceed to the nearest restroom, wash exposed portions of the body and remove outer garments. Remain in or near the restroom until you have checked for contamination.

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Ex 2

14. Sequence of Operations.

a. Pre-Entry Requirements.

(1) Obtain advanced approval of the Supervisor of Radiation Facilities or his designated representative.

(2) Register in office for film badge (if not permanently assigned) and personnel monitoring equipment (dosimeter, chirpee).

(3) Accompany approved operator (who has signed out for the Underground Vault Keys) to locked entrance of Vault Console Room.

b. Entry into Console Room. Upon entering the Console Room operator will:

(1) Activate equipment by turning on main electrical switch on wall panel.

(2) Open valve supplying air pressure to source controls.

(3) Open valve at bottom of filter to remove all water from air lines.

(4) Check readings of monitors for the console room and the one for the source exhaust air.

(a) If the Console Room Area monitor indicates that the exposure rate is over 2 mR/hour, notify the Supervisor of Radiation Facilities or the RD&E Radiological Safety Office (X65292).

(b) If the exhaust air monitor reads over 3 mR/hour follow the instructions in Item 13c, "EMERGENCIES", above.

c. Entry into the Exposure Room.

(1) Make sure all entrants have required dosimeters and radiation instruments in addition to their film badges.

(2) Check and make sure both sources are down, in storage position and that the ( ) source storage plug is down.

(3) The operator will place the source control switch key in his pocket and keep it there.

(4) The first individual to enter the Exposure Room must take survey meter readings before and during entrance.

Ex 2

(5) Check survey meter at end of maze to insure that the source is in its safe position.

(6) When setting up equipment for exposures do not lean over source rise tubes.

d. Raising the Source.

(1) Make sure all equipment is secure and in correct position.

(2) Remove all excess cables and wires.

(3) Leave Exposure Room making sure to bring survey meter out.

(4) The operator in charge will check the Exposure Room to insure that everyone is out of the room before proceeding to (5) below.

(5) Close lead clad maze door to maze and the exposure room making sure interlock closes and green light shows on console.

(6) Check the level of solution in the zink bromide window. Green light on console should be ON.

(7) To use Source 1 (660 Ci source) only.

(a) Open air valve for Source 1. Assure that air valve for Source 2 is closed.

(b) Check air pressure gauges. The pressure for the Source 1 UP gauge should be between 8 and 18 psi while the pressure on the DOWN gauge should be between 18 and 25 psi. The pressure on the Source 2 UP gauge should be 0. If the air pressure is beyond the ranges given, contact the Supervisor of Radiation Facilities before proceeding.

(c) Using the mechanical arm raise the lead storage plug and lock in UP position by pushing the bowden cable handle.

(d) Insert the key in source control switch. Turn the key clockwise. This will activate air control and raise source 1 to the exposure position where it will be held by spring loaded pins. Red light on console will light as well as red lights in upper hallway and outside on building and earth mound. As long as source is in the UP position these lights will remain on.

(8) To use Source 2 [ ] only.

(a) Open air valve for Source 2. Assure that air valve for Source 1 is closed.

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(b) Check air pressure gauges. The pressure for the Source 2 UP gauge should be between 50 and 60 psi while the pressure on the DOWN gauge should be between 18 and 25 psi. The pressure on the Source 1 UP gauge should be 0 psi. If the air pressure is beyond the ranges given, contact the Supervisor of Radiation Facilities before proceding.

(c) Insert the key in the source control switch. Turn the key clockwise. This will activate air control and raise Source 2 to the exposure position where it will be held by the air pressure. Red light on console will light as well as red lights in upper hallway and outside on building and earth mound. As long as source is in the UP position these lights will remain on.

(9) To use both Source 1 and Source 2 at the same time.

(a) Open air valve for Source 1 and air valve for Source 2.

(b) Check air pressure gauges. The pressure for the Source 1 UP gauge should be between 8 and 18 psi, the pressure for the Source 2 UP gauge should be between 50 and 60 psi and the pressure on the DOWN gauge should be between 18 and 25 psi. If the air pressure is beyond the ranges given, contact the Supervisor of Radiation Facilities before proceeding.

(c) Insert the key in the source control switch. Turn the key clockwise. This will activate air control and raise both sources to the exposure position. Red light on console will light as well as red lights in upper hallway and outside in building and earth mound. As long as source is in the UP position these lights will remain on.

(10) If overnight or weekend exposures are required, notify the Fire Department on X65432, also the security guards X65670.

e. Lowering the Sources.

(1) Insert key in source control switch and turn it counterclockwise. This lowers sources into storage containers. All remote monitors should return to zero, red lights will go out and green light will appear on console.

(2) Pull handle of bowden cable, releasing safety plug so it can be returned to the down position. Using mechanical arm lower lead storage plug to the DOWN position.

(3) Close air valves for sources 1 and 2.

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Ex 2

(4) Lower lead shield covering window if it is in its UP position.

(5) Open lead shield door leading to exposure room.

(6) Turn on exhaust fan to remove ozone air due to exposure.

(7) Take survey meter and enter exposure room to remove equipment or make changes for further exposures.

f. Leaving Underground Vault.

(1) Make sure all excess equipment, cables, etc. are removed from exposure room.

(2) Make sure you have the keys to both the source switch and the door of the vault before leaving.

(3) Turn off air pressure valve to source controls.

(4) Turn off all radiation monitors.

(5) Turn off air vent blower.

(6) Pull main electrical switch.

(7) Make sure door to entrance of Underground Vault is locked.

(8) Turn in all personnel monitors and sign out in office.(Bldg. 401)

15. Periodic Inspection and Maintenance Procedures.

There are four interlocks that keep the sources from raising.

a. The lead door to the exposure room is controlled by a micro-switch. If the door light on the control panel is red, the sources will not go up, if either source is up and the door is opened the action of the interlock will cause the source to be lowered into the storage container.

b. Zinc bromide level. There is a micro-switch on a float to check the level of the zinc bromide filled window. If the indication light is red the source will not go up. If the window liquid should leak out into the exposure room and not be apparent in the control room, a drop in the level of the zinc bromide liquid will cause the float to activate the micro-switch. If the source was in the exposure position it would activate the air valve, lowering the sources back into the storage containers making it safe to enter the control room.

c. Radiation monitors. There is a toggle switch on the control panel that turns the Victoreen area monitors off in case they need to be worked on. If this switch is in the off position the sources cannot be raised. The control room monitor is set at 3 mr/hr, and the exhaust air monitor is set at 3 mr/hr. When the control power is turned on, the needles go up to these settings and the warning bell comes on. Each meter has to be reset to release the warning bell interlock.

d. The sonic alarm system must be in the on position or the sources will not raise. When the system is first activated the warning bell will ring until the system reaches equilibrium.

e. All of the interlocks work with air-electric valves. When the source is not in use, the air shut off valve is turned clockwise to the closed position. The air shut off valve must be turned counterclockwise to the open position before the sources can be raised. The sources cannot be raised to exposure position if there is no air pressure.

f. The following checks will be made every six months (March & Sept):

(1) Turn on main power to control panel and console containing monitoring system by closing knife switch located on electrical panel at the foot of the stairs.

(2) Check all lights on console and control panel. The following lights should be on.

(a) Control panel

Source switch (key) green

Sonic alarm - green

Door to exposure room - red (open) green (closed)
Window - green

Monitors - green

(b) Console

Alarm: Red light will show and alarm will ring until system equalizes. Green light will show, alarm will shut off.

Remote monitors: All meters should be lighted. All monitors should be to zero with red lights out. If red light shows on monitor - reset button must be pushed and held until light stays out. It takes time for monitors to reach equilibrium if the system has been off.

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(3) Check interlock on lead door leading to exposure room. When door is closed red light on control panel should go out and green light should show.

(4) Check float level of zinc bromide window, green light should go out and red light activate when float is pushed lower in the solution.

(5) Check operation of lead shield cover for zinc bromide window by throwing switch located on the control panel up or down, to raise or lower. Check limit stop switches by running until windows stops automatically at both up and down positions.

(6) Check source 1 safety plug operation by raising plug with mechanical arm attached to it. Check operation of bowden cable holding device, locking plug in up position by pushing in on bowden cable control located above bromide window. Check release of safety plug by pulling handle of bowden cable. This should unlock plug and allow it to return to the down position.

(7) Check remote monitoring meters on console. If power transit has produced high reading(s) push reset button(s).

(8) Check sonic alarm lights and meter. Green light should be on and meter should be in center position. Warmup period will be required to stabilize if system has been idle for a period of time.

(9) Turn on air valve, located on rear wall. This supplies air to the source operating system. Observe air gauges for up and down pressures. UP pressure for source 1 should be between 12-14 lbs, UP pressure for Source 2 should be between 50 and 55 lbs and DOWN pressure approximately 18 lbs. Adjust if necessary.

(10) Check each source operation as follows:

(a) Close lead door leading into source room, green light should show.

(b) Check window float level, green light should show.

(c) Check source key switch, green light should show.

(d) Raise lead safety plug for checking Source 1 using mechanical arm and lock in up position with bowden cable control.

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(e) Using source control key, turn switch clockwise, this activates air control valves and raises source to exposure position. Red light on source control switch should activate, green light should go out. Remote area monitor in source room and in maze should show indications of radiation. Red lights in upper-hallway, outside wall of vault and on mound should light.

(f) Source should remain in exposure position when key is returned to center position.

(11) Check each source safety operations as follows:

Source in exposure position.

(a) Turn switch key to counter-clockwise position, source should return to storage container and green light should come on.

(b) Open lead door leading to exposure room, source should immediately lower into storage container; red door light on control panel should show.

(c) Push up on back of float level for zinc bromide window forcing float lower in solution, source should automatically lower to storage containers, float level red light should come on.

(d) Check sonic alarm by creating an excessive noise or whistle. This should cause the source to lower into the lead storage container and activate an alarm bell in the hallway above the entrance way. This can be reset on manual by using the reset switch on the console if on automatic, it will reset itself.

(e) Check loss of power by opening knife switch on electrical panel controlling console power. With power off or interrupted, source should automatically return to its lead storage container, green source-light should activate.

(12) Emergency generator check.

Located in a shelter just outside Building 401. Unit consists of a standard Army power unit PU 26-A/U with engine starting controls and an automatic transfer switch. This unit has the capability of automatically starting if any of the three phases are out and shuts off automatically when normal service is restored. This unit supplies emergency power to the control panel and the console of the underground vault so that the source can be put into operation if necessary. A standby compressor to supply air pressure is also housed in the shelter to supply emergency air pressure if needed.

(13) To check for operation.

Just inside the door on the wall is a circuit break box. The three main circuit breakers are tied together on the box so that normal service can be cut off. To check put these circuit breakers in the off position. This will activate the automatic engine starting control and will crank the engine. If the engine does not start in 10 seconds there will be a pause of 10 seconds before it tries to start again. This cycle is repeated for 3 times. After the engine starts the automatic transfer switch throws the load on the generator, activating the control panel and console in the underground vault. An emergency light is also connected to this circuit to give light in the vault.

Throwing the circuit breaker back to the on position causes the transfer switch to put the load on normal service and the engine shuts off automatically.

(14) Calibration and Check of Remote Monitoring System

This system provides separate readout, in the control room, of the dose rate at each of the five remote sensing units. The units have logarithmic meter readout covering three decades. Three of the units have 1 to 1000 mR/hr ranges. The fourth unit covers 100 to 100,000 mR/hr and the fifth 0.1-100 R/hr. Radiation levels in excess of pre-set alarm conditions are indicated by a red alarm light for each unit. The system operates on 115V, 60 hertz supply.

The following detailed procedure may be followed to recalibrate any suitable combination of remote radiation sensing unit and plug-in station unit:

(a) Turn on the remote area monitoring system and allow it to warm up for 10 minutes. Remove the small cover plate on the front of the plug-in station unit, thus exposing the three screw-driver adjust potentiometers: Track, Span and FIL current adjust as well as the filament current measuring jack.

(b) Measure the filament current by plugging into the filament current measuring jack (J-201) a 0.25 V millivoltmeter. Adjust the FIL current adjust potentiometer until the meter reads 0.25V. A model 630 Simpson multimeter switched to the 100 micro-ampere DC range can conveniently be used as a 0.25V millivoltmeter. The proper plug for J-201 is a Switchcraft No. 480 (JAN PJ-068 or WE 39) plug. Changing the filament current shifts the static level of electrometer tube plate current without appreciable changing the charge in plate current per decade change in signal or ion current. Moving the FIL adjust potentiometer, therefore, has the same

affect as moving the RANGE potentiometer, without affecting the proper setting of the SPAN potentiometer. Measurement of the filament current is desirable primarily to establish that the resistor string, of which the filament is a part, has the proper current and that the zener diode is operating properly.

(c) Irradiate the remote radiation sensing unit connected to the plug-in station unit in question with a gamma radiation field of the intensity indicated on the left end of the meter scale. Adjust the RANGE potentiometer (R-203) on the front panel of the plug-in station unit until the meter reads correctly.

(d) Irradiate the remote radiation sensing unit with the second gamma radiation intensity preferably at least a decade higher than that used in step 3. Without changing the position of the RANGE control, adjust the SPAN control (R-205) until the indicating meter again reads correctly.

(e) In the event that either step (c) or step (d) cannot be accomplished properly, change the position of the FIL current adjust potentiometer to provide a different filament current and repeat steps (c) and (d).

(f) In the event that it is inconvenient to irradiate the remote radiation sensing unit with an intensity equivalent to the left end meter scale reading (the lowest measurable radiation intensity), any two known on-scale radiation intensities may be utilized for calibration. However, it will be necessary to arrive at successive approximations for the proper adjustment of the SPAN and RANGE controls by performing steps (c) and (d) two or three times, since the SPAN and RANGE controls are not independent of each other for radiation intensities other than that indicated in the previous steps.

(g) Tighten all locks on the screw driver potentiometers and replace the cover plate on the plug-in station unit.

The RANGE control may be adjusted at any time through the use of the built-in calibration device. This RANGE control is provided on the front panel to permit adjustment to compensate for minor long term drifts in the instrument. Its position will not affect the proper SPAN setting or the change in meter reading per decade change in signal or ion current.

g. In addition to the checks described in f the following are performed at the interval indicated.

(1) Sources are leak tested every six months.

(2) Source 1 head holding mechanism is checked for wear and adjustment every 3 months.

(3) Micro-switch on holding heads are inspected and tested for radiation damage every 3 months.

(4) Wooden platform in source room is checked yearly and replacement made if any radiation damage is present.

(5) Mercury vapor lamps in exposure room are checked every 3 months, and replaced or repaired if necessary.

(6) Air system is inspected for leaks every 3 months.

(7) Filter in air line is drained and purged every month to remove water collected from the air.

(8) Bowden cable is checked for operation and loose connections every 3 months.

(9) Safety back-up system is checked every 3 months.

(10) Remote monitoring systems are checked and calibrated every 6 months.

(11) Air compressor is oiled and checked every month.

(12) Emergency power generator and switching mechanism is checked weekly.

(13) Battery for power generator is checked and maintained monthly.

(14) Air vent blower is checked and oiled every 3 months.

(15) Dehumidifiers are checked and oiled every 6 months.

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